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## Claims

1. A method for the non-destructive chemical analysis of test objects (1) by means of irradiating the test object (1) with neutrons  $n$  generated by target-free fusion of concentrically accelerated deuterium ions and measuring the amount of gamma photon radiation emitted promptly by the test object (1) during the irradiation from the number of gamma photon quanta and the respective photon energy ( $E_\gamma$ ) in order to record a photon energy spectrum (6), characterized by
  - determining characteristic photon energies ( $E_\gamma$ ) from the amounts of gamma photon radiation from the entire photon energy spectrum (6) which exceed background photon radiation, at least as far as the region of 12 MeV, and
  - determining the elements and/or isotopes of the test object (1) by assigning the characteristic photon energies ( $E_\gamma$ ) distributed over the entire photon energy spectrum (6) to corresponding elements and/or isotopes which are in each case stored unambiguously in relation to a photon energy ( $E_\gamma$ ).
2. The method as claimed in claim 1, characterized by quantitative determination of the chemical element composition of the test object (1) by means of measuring the complete measurable range of the photon energy spectrum (6) and determining the proportions of the elements and/or isotopes determined by relating the amount of gamma photon radiation per element and/or isotope to the entire amount of photon radiation determined for all the characteristic photon energies ( $E_\gamma$ ) determined.
3. The method as claimed in claim 1 or 2, characterized by determining the amount of gamma

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photon radiation by determining the areas of the characteristic pulse curves of the photon energy spectrum (6) in the regions of the characteristic photon energies ( $E_\gamma$ ).

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4. The method as claimed in one of the preceding claims, characterized by recording a base photon energy spectrum of the test chamber without the test object (1) and calculating a photon energy spectrum (6) used for evaluation from the difference between the photon energy spectrum (6) recorded for the analysis and the base photon energy spectrum.
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- 15 5. The method as claimed in one of the preceding claims, characterized by irradiating sections of the test object (1) from a plurality of directions and evaluating the plurality of measurement results for the purpose of location-dependent analysis of the test object (1).
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6. A device for the non-destructive chemical analysis of test objects (1), comprising a neutron source (2) for briefly irradiating the test object (1) with neutrons (n) and comprising at least one photon detector (3) aimed at the test object (1) in order to measure the quantity of gamma photon radiation emitted promptly by the test object (1) immediately after the irradiation from the number of photon quanta and the respective photon energy ( $E_\gamma$ ), characterized in that the neutron source (2) is a neutron generator (2) arranged beside the test object (1) and an evaluation computing unit (5) is coupled to the at least one photon detector (3), the evaluation computing unit (5) being designed to carry out the method as claimed in one of the preceding claims.
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7. The device as claimed in claim 6, characterized in that the neutron generator (2) is mobile.
- 5 8. The device as claimed in claim 6 or 7, characterized in that the at least one photon detector (3) is shielded by means for the absorption of neutrons (n).
- 10 9. The device as claimed in one of claims 6 to 8, characterized by a focusing element between the neutron generator (2) and the test object (1), the focusing element being designed for the thermal adaptation of the neutrons (n).
- 15 10. A computer program having program code means for carrying out the method as claimed in one of the preceding claims when the computer program is executed on a computer.
- 20 11. The computer program as claimed in claim 10, having a database, characterized in that the database contains the characteristic photon energies ( $E_\gamma$ ) of the elements and/or isotopes.
- 25 12. The computer program having program code means as claimed in claim 10 or 11, which are stored on a computer-readable data medium.
- 30 13. A database having a large number of entries of characteristic photon energies ( $E_\gamma$ ) based on associated elements and/or isotopes for use in order to carry out the method as claimed in one of the preceding claims.